



EQUIPMENT UTILIZATION IN CRITICAL CARE AREAS OF A TERTIARY CARE HOSPITAL IN PUNE

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ABSTRACT

Equipment has major role in hospital and health care services as an aid to health professionals, in providing efficient diagnostic and therapeutic tools. It helps to make the identification of the disease problem and their accurate and appropriate cure. Modern hospitals utilize a wide range of equipment for diagnostic, therapeutic and research. Many times these instruments are purchased without prior assessment of availability of technical knowledge and facilities for repairs and maintenance. In most of the hospitals biomedical department is available and repairs are done by some technicians, biomedical engineers or it is done by the companies under contract.

Any health care unit's efficiency is judged by its quality indicators. The availability and optimal utilization of medical equipment is important for improving the quality of health services. Investments are made for the purchase, maintenance and repair of medical equipment. Inadequate management of this equipment will result in financial losses to the institution. It is generally seen that few of the hospitals in India attempt to evolve their own parameters either taking ideas from the established parameters or from their experience in Indian hospitals.

In present study, it was found that, overall process of care was good although there were some grey areas of sub-optimal utilization of resources.

KEYWORDS: Equipment, efficiency, Hospital, utilization.

INTRODUCTION:

Equipment is defined as "all items necessary for the functioning of all services of the facility, including such services as accounting and records, maintenance of buildings and grounds, laundry, public waiting room, public health and related services."^[1]

However, the term medical equipment excludes implantable, disposable, or single-use medical devices, explains WHO medical device technical series.^[2]

Utilization essentially means the use of the equipment to its full potential. Clear vision and thought regarding the use of the equipment are necessary so that realistic performance may be set. It should be the endeavour of the management to optimize the equipment utilization to obtain maximum return for the capital invested. Proper utilization of the hospital equipment will lead to optimal patient handling and rapid turnover, minimum possible cost, quality patient care and satisfaction.

In 1999, the Hospital under study ranked first in India for having the most number of Critical Care Unit beds i.e. 76, leaving behind other renowned hospitals of the country. The number of Critical Care Unit beds available now has increased to 130, having various departments as Intensive care unit (ICU), Cardiac Care Unit (CCU), Neuro Trauma Unit (NTU), Neonatal Intensive Care Unit (NITU), Paediatric Intensive Care Unit (PICU). Hence the need for proper utilization of the resources of critical areas is of at most importance to maintain the quality and profitability of the hospital. Equipment are one of the most valuable fixed assets of the hospital. Increasing the number of critical care beds should not compromise the utilization of equipment.

It is estimated that around 50% of medical equipment in developing countries are functioning, not used correctly, and invariably not maintained, with serious consequences for patient care^[3]. This may be because the equipment was not needed or not appropriate and most often lies idle for want of spare parts. It is critical therefore that a medical device management policy exists that includes a financial provision for maintenance, spare parts and training, in initial cost of the equipment.

Hence proper study on the equipment utilization is needed on the regular basis. On the basis of equipment utilization chart prepared, each aspect of equipment utilization has to be analysed.

Aim:

To study the utilization of equipment in critical care areas

Objectives:

- 1) To prepare the list of equipment used in Critical Care Areas.
- 2) To measure capacity utilization time of equipment.
- 3) To find out an optimum solution to maximize the utilization of equipment.

- 4) To find out the solution to reduce the idle time for availability of limited machines.

Scope:

The study is limited to few of the critical and commonly used equipment in the Critical Care Area of the hospital.

REVIEW OF LITERATURE:

Proper maintenance of medical equipment is essential to obtain sustained benefits and to preserve capital investment. Medical equipment must be maintained in working order and periodically calibrated for effectiveness and accuracy of the results.^[4]

The Maintenance consists of:

- a. Planned Preventive Maintenance
- b. Breakdown Maintenance

a. Planned Preventive Maintenance (PPM)

Planned Preventive Maintenance involves maintenance performed to extend the life of the equipment and prevent its failure. Planned Preventive Maintenance is usually scheduled at specific intervals and includes specific maintenance activities such as lubrication, calibration, cleaning (e.g. filters) or replacing parts that are expected to wear (e.g. bearings) or which have a finite life (e.g. tubing). The procedures and intervals are usually established by the manufacturer. In special cases the user may change the frequency to accommodate local environmental conditions.

Planned Preventive maintenance will be a statutory requirement for most of the medical equipment. It will enhance the efficiency, effectiveness and reliability of medical equipment and must be carried out at appropriate frequency as suggested by the manufacturer/service provider.

Each equipment on the inventory will show whether it is

- a. maintained in-house
- b. maintained by external agency or manufacturer.

The conditions for preventive maintenance required for medical equipment can vary due to factor such as type of equipment, age of the equipment, frequency of use of the equipment, etc.

The record of Planned Preventive Maintenance should be maintained department wise and must include following details:

1. Reference ID as per inventory
2. Equipment Name.
3. Company/Make

4. Serial No.
5. Date of Installation
6. Warranty Period
7. Under AMC/CMC
8. Frequency of Preventive Maintenance/Calibration.
 - a. As per manufacturer guidelines.
 - b. Presently being followed.
9. Preventive Maintenance/Calibration Done On.
10. Preventive Maintenance/Calibration Due On.
11. Expenditure with cost and details.
12. Remarks with Functional Status.

Important factors affecting utilization of equipment:

Medical equipment is expensive to procure and maintain. There are various factors which must be considered for their optimal utilization. The important factors are:^[5]

Training of the staff:

Timely and appropriate training should be given the staff for handling and operating the equipment is a necessary for effective and optimum utilization of equipment.

Equipment installed on turnkey basis:

It has been observed that costly equipment installed on turnkey basis have better utilization as equipment planning considers factors like civil, electrical, air-conditioning installation, etc., which are ensured by the firm. Thus the equipment when handed over to the hospital is fully functional. Prior to the commissioning of the facility, adequate numbers of personnel are already trained by the firm installing the equipment.

Preventive maintenance and after-sales services:

Insisting on regular after-sales services of the equipment and a proper system of preventive maintenance, downtime of costly and essential equipment can be considerably reduced thereby increasing utilization. Normally the annual maintenance cost of equipment varies from 1-4 percent of the capital cost of the equipment. By ensuring availability of repairs, maintenance, and necessary spares, equipment utilization can be significantly increased.

Facility for back-up power supply:

As most of the vital and essential equipment are functional on electricity or chargeable battery supply, facility for back-up power supply should be ensured. Some arrangement has to be made in the form of standby generator or if possible uninterrupted power supply (UPS) units.

Time scheduling of the hospital:

Hospital timing should be scheduled in such a way that there is optimum utilization of the costly equipment. Usually in government hospitals, the facilities work only for 8 hours or one shift which amounts to 33 percent of utilization. If these facilities are made available for two shifts, high cost equipment may be utilized for 50-60 percent of their capacity.

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The conditions for preventive maintenance required for medical equipment can vary due to factor such as type of equipment, age of the equipment, frequency of use of the equipment, etc.

METHODOLOGY:

Source of data:

The data was collected from the records maintained in the CCU of a Tertiary care hospital in Pune.

Method collection of data:

The data for the utilization and management of medical equipment was collected by studying the records maintained, and also by questionnaire method from the staffs working in CCU and biomedical department.

The nursing staffs, biomedical staffs and technicians working in CCU were included for the study.

To measure capacity utilization time format was made and readings are taken according to that. Everyday readings were taken according to format. Actual utilization time of machines was calculated from secondary data from respective critical care departments. Engineered output was calculated with the help of secondary data from biomedical department.

Readings were taken for 30 days for 720 hours.

Capacity utilization of equipment:

Equipment has major role in hospital and health care services as an aid to health professionals, in providing efficient diagnostic and therapeutic tools. It helps to make the identification of the disease problem and their accurate and appropriate cure. Modern hospitals utilize a wide range of equipment for diagnostic, therapeutic and research. Many times these instruments are purchased without prior assessment of availability of technical knowledge and facilities for repairs and maintenance. In most of the hospitals biomedical department is available and repairs are done by some technicians, biomedical engineers or it is done by the companies.

The capacity utilization usually refers to capacity utilization rates, and is called an operating rate. It represents the relationship between actual output and potential output that could be achieved with labour force and capital stock.

This is shown in a percentage rate; one hundred (100) percent implies full capacity.

If a hospital operates at a 70% capacity utilization rate, it illustrates that there is a possibility to improve its production by 30 percent without additional fixed costs, such as the cost of building a new facility.

Formula used to measure Capacity Utilization Rate:

The capacity utilization rate can be ascertained using the formula

$$\text{Actual Output} / \text{Potential Output} \times 100$$

Actual output is time measured in 1 month

Potential output is 720 hours.

Format for capacity utilization equipment

	Date:			
	Department:			
Bed no	EQUIPMENT NAME	SR no	On time	Off time

Equipment Utilization in CCU:

- 1) **Monitor utilization:** Given below is the graphical representation of utilization of monitors in Cardiac care unit.

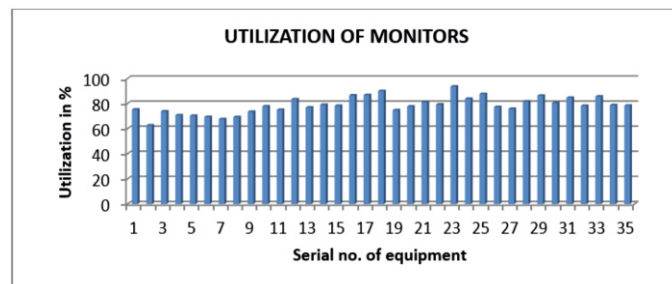


Figure 12: Graph on utilization of monitors in CCU

Maximum utilization of monitors in CCU is 93%

Minimum utilization of monitor in CCU is 62%

- 2) **Ventilator utilization:** Given below is the graphical representation of Utilization of Ventilators in Cardiac Care Unit.

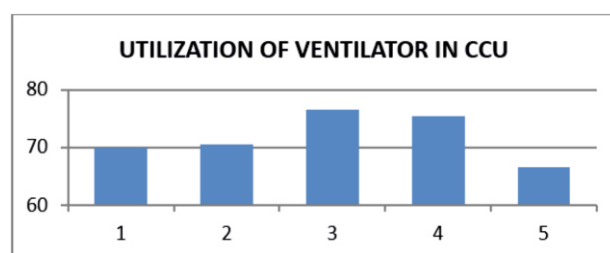


Figure 13: Graph on utilization of ventilator in CCU

Maximum utilization of ventilator in CCU is 76%

Minimum utilization of ventilator is 66%

- 3) **Echo machine utilization:** Given below is the graphical representation of utilization of Echo machine in Cardiac Care Unit.

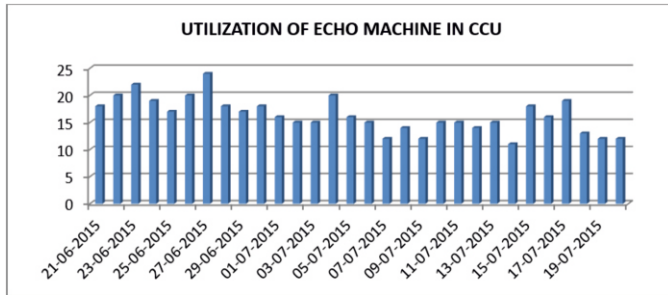


Figure 14: Graph of utilization of echo machine in CCU

Maximum utilization of Echo machine in CCU is 23 times in a day.

Minimum utilization of Echo machine is 12 times in a day.

- 4) **Portable X ray machine utilization:** Given below is the graphical representation of utilization of Portable X Ray machine in Cardiac care unit.

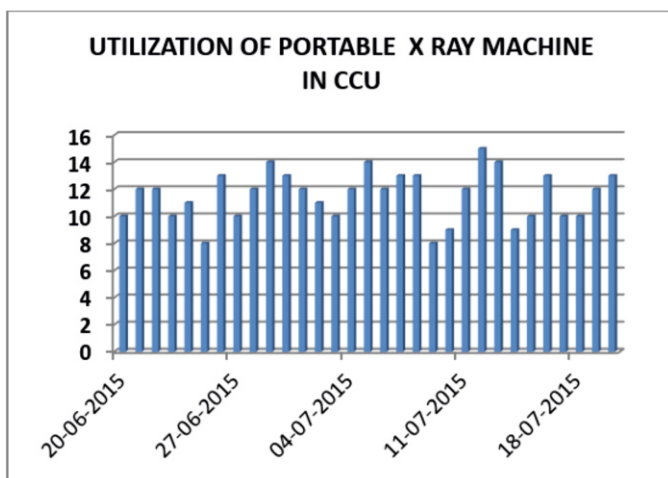


Figure 15: Graph of Utilization of X-ray machine in CCU.

Maximum utilization of x ray machine is 15 times in a day.

Minimum utilization of x ray machine is 8 times in a day

- 5) **ECG machine utilization:** Given below is the graphical representation of utilization of ECG Machine in Cardiac care unit.

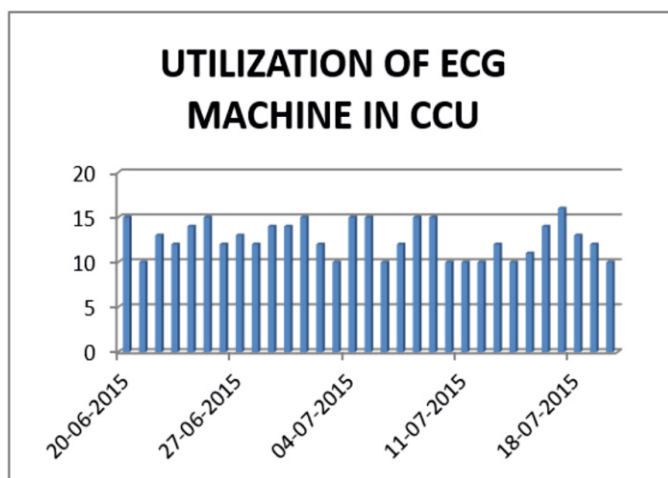


Figure 16: Graph on utilization of ECG machine in CCU

Maximum utilization of ECG machine is 16 times in a day.

Minimum utilization of ECG machine is 10 times in a day.

- 6) **Syringe Pump utilization:** Given below is the graphical representation of utilization of syringe pump in cardiac care unit.

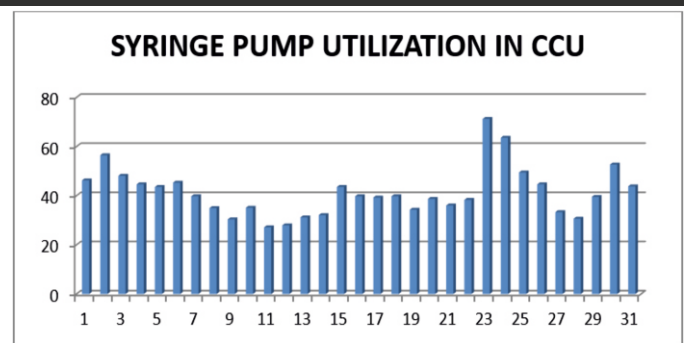


Figure 17: Graph on Utilization of syringe pump in CCU.

Maximum utilization is 70%.

Minimum utilization is 27%.

OBSERVATIONS:

- 1) Critical Care Unit, CCU was well equipped and well managed.
- 2) Preventive maintenance is done on the time.
- 3) Breakdown of equipment was handled in minimum time.
- 4) Equipment calibration was done time to time by biomedical department.
- 5) Equipment utilization was maximum in the ICU and CCU.
- 6) Capacity utilization of monitor was maximum in all critical care units in the hospital observed.
- 7) Equipment which were shared by units are not returned on the time.
- 8) Lack of training programmes for proper handling and maintenance of equipment for the fresher.
- 9) Separate echo machine should be provided to CCU.
- 10) ECG machine in ICU should be changed.
- 11) ICU staff needs training session on operating ventilator.

RECOMMENDATIONS:

- 1) **Equipment bank system:** Equipment which is extra or not in use, should be kept together in a single department.

Whenever any equipment is required in any department it should be taken from this bank.

Record should be maintained for this. Advantages will be :

- a) It will prevent loss of equipment.
- b) It will be easier for maintenance.
- c) It will reduce waiting time for equipment.

- 2) **Use of software:** HMIS software can be used for inventory management.

- 3) **Use of RFID (Radio Frequency Identification):** In RFID system tags are affixed to equipment.

In addition to the tags, an RFID system consists of the RFID reader, an antenna, and the software and hardware necessary for communication

It helps to track the equipment.

RFID systems can help hospitals reduce the need to over purchase by making it easier to locate equipment when it is needed, resulting in cost reductions in asset inventories.

RFID helps in recoding equipment utilization, which includes knowing where the equipment is located at all times, who uses it and for how long.

Active RFID tags can be used for equipment.

- 4) **Equipment Audit:** A retrospective evaluation of quality of performance of equipment in a hospital by an equipment audit committee based on documented records of the equipment at the time of purchase and its subsequent maintenance.

CONCLUSION:

A proper utilization of medical equipment is needed in the hospitals under the critical care section especially which can provide minimum cost to the hospital as well as quality care to the patients.

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